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p-channel MOSFET

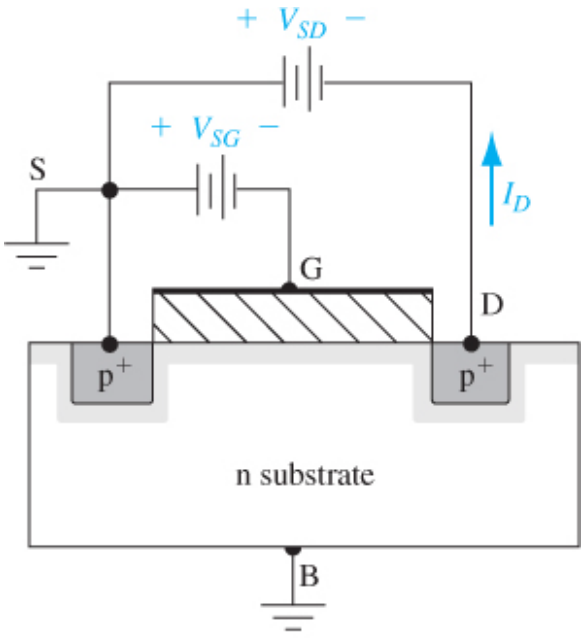

Figure 10.49 | Cross section and bias configuration for a p-channel enhancement mode MOSFET.

- Here, $V_{SG} = -V_{GS} > 0$ and $V_{SD} = -V_{DS} > 0$. Positive charges (holes) flow through p-channel from source (S) to drain (D) and I_D emerges from drain.
- Linear region $I_D = \dfrac{W\mu_p C_{ox}}{2L}\left[2\left(V_{SG}+V_t\right)V_{SD} - V_{SD}^2\right]$ where $0 \le V_{SD} \le V_{SD}(\text{sat})$

  or $V_{SG} > V_T$ and $V_{SD} < V_{SG} + V_T$
- Saturation region $I_D(\text{sat}) = \dfrac{W\mu_p C_{ox}}{2L}\left(V_{SG}+V_t\right)^2$ where $V_{SD} \ge V_{SD}(\text{sat})$
- Saturation voltage $V_{SD}(\text{sat}) = V_{SG} + V_T$
- Threshold voltage $V_T < 0$ for an **enhancement mode** p-channel MOSFET.
- Threshold voltage $V_T > 0$ for a **depletion mode** p-channel MOSFET where the inversion layer exists when $V_G = 0$.